

RECENT DEVELOPMENTS IN GULLY EROSION RESEARCH AND THEIR IMPLICATIONS FOR CONTROLLING SOIL LOSS AND SEDIMENT YIELD

(Keynote)

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Soil erosion by water causes significant soil degradation worldwide. Most erosion process research and erosion control has focussed on sheet and rill erosion. Relatively little research has dealt with (ephemeral) gully erosion which is illustrated, for instance, by a recent review of soil erosion studies in Europe (Boardman and Poesen 2006). Gullies typically occupy less than 5 % of the upland area, but gully erosion may be held responsible for relatively large soil losses (up to 80 %) by water erosion and related sediment production with significant on and off site consequences. Hence, controlling soil erosion in concentrated flow zones pays off. However, innovation in research on gully erosion control is rather limited compared to progress in research on gully (or more generally concentrated flow) erosion processes (Poesen et al. 2003). The objectives of this study are therefore to review recent developments in gully erosion research that have implications for improving the effectiveness of (ephemeral) gully erosion control measures and to formulate some important challenges.

Various techniques can be applied to control ephemeral gully erosion rates by increasing topsoil resistance to erosion by concentrated flow : e.g. conservation tillage, avoiding sub soiling, soil compaction, increasing crop density (double drilling), stimulating microbiotic crust development and establishing grassed waterways. Other techniques include the planting of selected species in concentrated flow zones (vegetation barriers) so as to interrupt sediment connectivity in the landscape. For this, a methodological framework is needed to select plant species based on suitable aboveground (e.g. stiffness, sediment trapping capacity) and belowground (e.g. fine root density and root tensile strength) biomass characteristics. Structural measures to control gully head cut retreat or gully channel deepening include the establishment of geomembranes, drop pipe structures and check dams. However, each of these techniques has a different effectiveness, advantages and disadvantages, depending on the environmental conditions as will be illustrated with examples from various countries.

Despite these recent developments, important challenges in gully erosion control research remain. Among these we list the following ones:

- the prevention and control of soil piping and tunnelling, as these erosion processes often precede gully initiation or are associated with rapid gully expansion;
- the prevention and control of large gullies in tropical and subtropical environments;
- the conditions for natural infilling of gully channels;
- the selection of suitable native plant species for controlling gully development in different environments taking both above- and belowground biomass characteristics into account;

- the long-term environmental impacts and sustainability of gully erosion control measures; and
- soil loss tolerance for gully erosion.

References

- Boardman, J. and Poesen, J. 2006. Soil Erosion in Europe. Wiley, Chichester, UK, ISBN 0-470-85910-5, 855 p.
- Poesen, J., Nachtergaele, J., Verstraeten, G. and Valentin, C. 2003. Gully erosion and environmental change: importance and research needs. *Catena* 50(2-4):91-133.